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MAGNESIUM DEFICIENCY IN AROOSTOOK POTATO SOILS

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Magnesium has been known for nearly a century to be one of the elements essential for plant growth. Plant physiologists tell us that it is a constituent of the chlorophyll molecule and that when it is lacking a disturbance in the formation of chlorophyll is soon noticed. Magnesium is said to function also as a carrier of phosphorus in plants and to play some part in the formation of oils in plant tissues.

AROOSTOOK SOILS ARE DEFICIENT IN AVAILABLE MAGNESIUM

If we grant that magnesium is necessary for plant growth the question as to whether or not magnesium is necessary in potato fertilizers becomes a question of whether or not sufficient quantities of magnesium are present in our potato soils. This question was brought to the attention of the Maine Agricultural Experiment Station in 1929 when a number of potato fields in Aroostook County showed stunted and chlorotic potato plants. The following year fertilizers with and without extra magnesium were used on two farms. The results of these tests showed that the addition of 51 pounds of magnesium oxide, in the form of Epsom salts, per ton of 4-8-7 fertilizer not only prevented the stunted and chlorotic appearance of the potato plants but also increased the yields by an average of 154 bushels per acre on the two farms.

TESTS WITH VARYING AMOUNTS AND DIFFERENT SOURCES OF MAGNESIUM

In 1931, varying amounts of magnesium oxide from three different sources were used in potato fertilizers on three different farms. The results[1] of this test were average increases in potato yields, of 3 to 36 bushels per acre.

In 1932, fertilizers containing additions of 0, 10, 20, 30, and 60 pounds of magnesium oxide from Epsom salts, double sulfate of potash-magnesia and dolomitic limestone were compared on five farms in Aroostook County. The farms were selected so as to represent a wide range in soil fertility.

That the farms upon which this test was conducted did represent a wide range in soil fertility is indicated by the range in yields obtained with the check treatment, namely, 211 to 484 bushels per acre (Table 1). Considering only the average yields for the five farms, the increases in yields due to additions of magnesium ranged from 2 to 29 bushels per acre. If the results obtained on individual farms are considered separately we find that the response to added magnesium was very definite on the first four farms, and negative on farm number 5.

In 1933, fertilizers containing additions of 0, 10, 20, 30 and 60 pounds of magnesium oxide from Epsom salts, double sulfate of potash-magnesia and dolomitic limestone were again compared on five different farms in Aroostook County. Considering again only the average yields obtained on the five farms, the increases in yield due to magnesium ranged from about 3 to 23 bushels per acre.

TABLE 1.—*Effect of Magnesium in Potato Fertilizers on Five Farms Varying Greatly in Soil Fertility*—1932

Treatment	Yield of check treatment and increases due to magnesium (bushels per acre)				
Check (2000 lbs. 4-8-7)	211	247	308	404	484
Check + Epsom salts	+49	+26	+35	+12	—17
Check + Sulfate potash-magnesia	+68	+21	+ 9	+13	— 3
Check + Dolomitic limestone	+44	+18	0	+ 8	—11
Average	+54	+25	+15	+11	—10

The increases and decreases over the check treatment represent the average effect of 10, 20, 30, and 60 pounds of added magnesium oxide from each of the above sources of magnesium.

The average increase in yield, due to magnesium over the two-year period ranged from 2.6 to 22.6 bushels per acre on the ten farms where this test was conducted. Due to the fact that six of these ten farms produced over 400 bushels of potatoes per acre and were therefore in a much higher state of fertility than the average farm in Aroostook County, it would seem logical to assume that practically all farms in Aroostook County will produce higher yields if magnesium is added to potato fertilizers. The results presented in Table 1 indicate that soils in a low state of fertility may show greater response to added magnesium than those in a high state of fertility. Thus it would appear that the increase in yield due to extra magnesium in potato fer-

tilizers would be even greater on the average farm in Aroostook County than that obtained on the farms upon which this test was conducted.

Obviously if magnesium is to be added to potato fertilizers it is of interest to know how much and in what form it should be added. The results presented in Table 2 do not definitely answer the question as to how much magnesium should be added. They indicate, however, that increased yields may be expected with added magnesium up to at least 30 pounds of magnesium oxide per acre unit (amount of fertilizer applied per acre) of fertilizer. The quantity of magnesium which will result in maximum yield on any particular farm will probably vary with the available magnesium content of the soil on that farm. Observations on the farms upon which magnesium tests were conducted in the past four years have indicated that no magnesium-deficiency symptoms[2]

TABLE 2.—*The Effect of Different Amounts of Magnesium Oxide in Potato Fertilizers*

Average Results from Ten Farms. 1932-1933

Source of MgO	Amount of MgO and its effect (bushels per acre)			
	10 lbs.	20 lbs.	30 lbs.	60 lbs.
Epsom salts	+12	+15	+20	+20
Sulfate potash-magnesia	+18	+17	+22	+23
Dolomitic limestone	+ 7	+ 3	+18	+11
High-calcium limestone*	—18	— 5	—11	—13

*High-calcium limestone contained only a trace of magnesium. The amounts of it used were the same as the amounts of 20 per cent dolomitic limestone necessary to furnish 10, 20, 30, and 60 pounds respectively of magnesium oxide. It was not added as a source of magnesium but merely to compare its effect with that of equal quantities of dolomitic limestone.

will develop on potatoes fertilized with a ton per acre of a 4-8-7 fertilizer to which 20 pounds of magnesium oxide in water-soluble form have been added.

With regard to source of magnesium for potato fertilizers the results obtained (Table 3) indicate that water-soluble carriers of magnesium are more effective in preventing magnesium deficiency than is magnesium in dolomitic limestone.

HIGH-CALCIUM LIMESTONE IN POTATO FERTILIZERS DEPRESSES YIELDS

In connection with the results from dolomitic limestone, it is interesting to note the results obtained by using high-calcium limestone in potato fertilizers (Tables 2 and 3). The amounts of high-calcium limestone used were equal to the amounts of 20 per cent dolomitic limestone necessary to furnish 10, 20, 30 and 60 pounds respectively of

magnesium oxide. It will be noted that in general the use of high-calcium limestone resulted in a depression of the yield. The writer is unable to offer a definite explanation for this effect. However, the high-calcium limestone may have rendered the small amounts of magnesium present in the soil less available to the potato plant. Some unpublished data on replaceable calcium and magnesium in Aroostook soils indicate a very wide calcium/magnesium ratio. Additions of high-calcium limestone to these soils would tend to widen this ratio and perhaps make it more difficult for plants to take in the small amounts of magnesium present.

THE EFFECT OF APPLICATIONS OF MAGNESIUM AFTER THE DEVELOPMENT OF SEVERE MAGNESIUM DEFICIENCY SYMPTOMS

In addition to the work with magnesium in potato fertilizers, supplementary tests were conducted to study the effects of adding mag-

TABLE 3.—*The Effect of Equal Quantities of Magnesium Oxide from Different Sources*

Average Results on Ten Farms. 1932-1933

Treatment	Acre yield (bushels per acre)	Increase or decrease (bushels per acre)
Check (2000 lbs. 4-8-7)	389	....
Check + Epsom salts	406	+17
Check + Sulfate potash-magnesia...	409	+20
Check + Dolomitic limestone	399	+10
Check + High-calcium limestone ..	377	—12

nesium to the soil as a top dressing or to potato plants in the form of spray after the potato plants had developed definite magnesium deficiency symptoms. These applications of magnesium were made during the first week in July which was 2 to 3 weeks after the plants had emerged. In these tests apparently uniform areas were selected which showed severe magnesium deficiency symptoms. Half of each area was treated with magnesium and the other half left untreated. It should be understood that the untreated and treated areas had received the same fertilizer application at planting time. In all cases marked response to added magnesium was noted in five to ten days after the magnesium was added. The chlorotic leaves did not seem to regain their green color but no more chlorosis developed on the old leaves after the addition of magnesium and all of the new growth had a

healthy green appearance. In the fall the untreated plants died early while the treated plants remained green until killed by late blight or frost.

The effect of the added magnesium on potato yields was surprisingly great as is indicated by the results in Table 4. It is particularly interesting to note the results obtained by adding 10 pounds of Epsom salts to each 100 gallons of bordeaux mixture which was applied six times during the season. Although only about one and two-thirds pounds of magnesium oxide per acre were added in each spray, a visible improvement in the appearance of the sprayed plants was noted within five days after the first spray was applied. This rapid response to such a small quantity of magnesium would indicate that the plants were able to absorb the magnesium through the leaves. This possibility is further substantiated by the fact that single-stalk plants on the outside borders of the plot which were not entirely covered with spray showed differential appearance between the portions covered and those

TABLE 4.—*Effect of Magnesium Applied as a Top Dressing to the Soil and in the Form of a Spray to the Plants after Severe Magnesium Deficiency Symptoms had Developed in Potatoes*

Farm and year	Check yield (bushels per acre)	Treatment	Increase over check (bushels per acre)
Daigle, 1932	259	320 lbs. Epsom salts	137
Daigle, 1932	223	320 lbs. Sulfate potash-magnesia	132
Bradstreet, 1933	276	320 lbs. Epsom salts	52
Woodman, 1933	199	320 lbs. Epsom salts	151
Woodman, 1933	224	60 lbs. Epsom salts sprayed on*	139

*Ten pounds of Epsom salts per acre sprayed six times on potato plants with bordeaux mixture. All other treatments applied as top dressing to the soil.

not covered with the magnesium spray. That is, the new growth on the portion of the plant sprayed with magnesium had a healthy green color while the new growth on the portion sprayed with standard bordeaux still had a chlorotic appearance. If the magnesium were taken up by the roots one would expect it to be equally distributed through the entire plant.

USE DOLOMITIC LIMESTONE AS A LIMING MATERIAL

Although the results presented show that magnesium deficiency in potatoes may be prevented by the addition of 20 to 30 pounds of magnesium oxide to potato fertilizers and that it may very largely be corrected, even after it appears, by top dressing or by spraying with magnesium, both of these methods are necessarily only a temporary means of preventing magnesium deficiency. The most economical and most practical method of preventing magnesium deficiency is by the use of dolomitic limestone as a liming material. The proper use of dolomitic limestone as a liming material will not only supply the necessary magnesium for potatoes at a relatively low cost but will also tend to bring about a more favorable soil reaction and thus result in increased yields of all crops grown in the rotation. By increasing the yields of clover and other green manuring crops the use of dolomitic limestone will tend to increase the organic content of potato soils and thereby increase potato yields beyond the increase due to magnesium alone. However, until the farmers in the magnesium-deficient areas generally adopt the practice of liming with dolomitic limestone it will be to the interest of both farmers and fertilizer manufacturers to have potato fertilizers contain 20 to 30 pounds of magnesium oxide, preferably in water-soluble form, per acre unit of fertilizer.

SUMMARY

Magnesium has been known for a long time to be an essential element for plant growth. Until recently it has been assumed that all soils contained sufficient magnesium to meet the requirements of potatoes and other agricultural crops. The results presented in this paper show that Aroostook soils do not contain sufficient magnesium for maximum potato yields. The amount of increase in yield resulting from the addition of magnesium to potato fertilizers depends upon the amount of available magnesium in the soil. Approximately 20 to 30 pounds of magnesium oxide per acre must be added to potato fertilizers to prevent magnesium deficiency in potatoes in Aroostook County. In fertilizers, soluble carriers of magnesium appear to be more effective than dolomitic limestone in preventing magnesium deficiency. Under Aroostook conditions the addition of high-calcium limestone to potato fertilizers results in a depression of the potato yields on most farms. Very material increases in potato yields may be obtained by the addition of magnesium as a top dressing or in the form of a spray on fields showing severe magnesium-deficiency symptoms. It is suggested that the magnesium may be absorbed through the leaves by potato plants.

Liming soils with dolomitic limestone is recommended as the most practical method of preventing magnesium deficiency.

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THE RESPONSE OF POTATOES TO MAGNESIUM UNDER VARIOUS SOIL CONDITIONS[1]

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Successful potato production on the longer cropped soils, from the nutritional standpoint, is becoming somewhat more difficult with each succeeding season. Results of experiments have shown that under certain situations the potato grower must use, for maximum production, elements which at one time were given very little consideration. Potato yields on some of the experimental plats and on different potato farms throughout Rhode Island have shown a marked decrease in yield during the past few years, even when supplied with optimum amounts of nitrogen, phosphorus, and potassium. This failure to respond, to fertilization combined with a physiological sickness of the plants in certain cases, suggested a deficiency in some essential element.

In 1931, potatoes growing on certain plats of the phosphate experiment at the Rhode Island Agricultural Experiment Station were stunted in growth and displayed a yellow color. This condition had been noted in previous years but seemed to be growing more severe with each succeeding season. The condition of the plants is best described as having insufficient green coloring matter or being chlorotic. Plants showing this condition, when treated with a small amount of magnesium sulfate, showed a very satisfactory response, thus indicating that a deficiency of magnesium was at least partially responsible for the disorder.

Jones[4] observed a chlorosis in corn at the Massachusetts Agricultural Experiment Station and isolated the causative factor as being a deficiency in magnesium. More recent investigations by Carolus[2] showed, from chemical analysis of the potato plant, that a deficiency of magnesium was causing a yellowing of the leaves. He found no relationship between previous fertilizer treatment and the occurrence of the

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disorder. The good/poor ratio of magnesium in good and poor plants showed a much higher content of magnesium in the healthy plants. Chucka[3] has reported very significant increases in the yield of potatoes from the use of magnesium sulfate in Maine.

EXPERIMENTAL

The results herein reported were taken from yield response secured from applications of magnesium to the Phosphate Experiment and to various potato fields in the State.

The Phosphate Experiment was started in 1894 to test the value of different carriers of phosphorus. The soil used in this study is classified as Merrimac silt loam. It is a well drained, medium heavy soil. The plats are two-fifteenths acre in size. Each phosphorus carrier is tested under two different soil conditions—one of the replications has been limed regularly, the other has received very little lime. At present the limed plats have a pH of approximately 6.25. On the less limed plats the pH is around 5.35. Two of the phosphorus carriers used are as follows: superphosphate 25, 80, and 240 pounds (P_2O_5) per acre, and rock phosphate 80 and 120 pounds (P_2O_5) per acre. The relative amount of P_2O_5 in the fertilizer has purposely been kept low in order to emphasize any difference in the carriers that might become evident.

The rotation consists of two years of truck crops followed by two years of grass. The standard fertilizer for truck crops is approximately 2,000 pounds of a 4-8-8 unless otherwise stated. For the grass crops the fertilizer is about one-half of the above amount. The nitrogen was obtained from nitrate of soda and sulfate of ammonia, each supplying one-half. The potash was supplied as muriate.

It was rather late in the growing season of 1931 before it was actually demonstrated that a magnesium deficiency was the probable cause of the disorder, thus no definite treatments were attempted that year. In 1932, plats 64 and 66 on the acid half of the experiment were used for magnesium treatment. The selection of these plats was on the basis of seriousness of the disorder in 1931. They are divided into north and south halves for different fertilizer treatment. The fertilizers applied for the cultivated crops were as follows: Plats 64 and 66, North halves—approximately 2,000 pounds of a 4-8-8, 64 South, 2,000 pounds of a 4-8-12, and 66 South, 2,000 pounds of a 6-8-8. On these plats the phosphorus was applied as superphosphate. Early in the growing season one-half of each of the above plats was treated with magnesium sulfate at the rate of 200 pounds per acre. This application was very effective in preventing the appearance of any of the previously observed

physiological disorders of the plants. The untreated plants were very poor in growth and exhibited a distinct yellow color throughout the summer with consequent drying-up in early fall. The yields obtained from these plats are presented in Table 1.

TABLE 1.—*Potato yields in bushels per acre on the experimental plats with and without magnesium in* 1932

	With magnesium			Without magnesium		
Plat	No. 1	No. 2	Total	No. 1	No. 2	Total
64N	229	44	273	109	55	164
S	171	36	207	80	47	127
66N	236	32	268	114	45	159
S	245	34	279	112	32	144
Average	220	36	256	104	45	149

From the results presented in this table the beneficial effect of magnesium sulfate is very apparent. The difference in degree of response with the various fertilizer treatments indicates that the previous fertilization may have considerable influence on magnesium deficiency.

COOPERATIVE EXPERIMENTS—1932

On a potato field at Slocum, Rhode Island, where potatoes have been grown for a number of years with a large annual application of fertilizer, it was reported that the plants failed to respond to fertilization. The plants exhibited symptoms similar to those observed on the plants grown in the experimental plats. With this information it seemed desirable to find out if the condition was related to a magnesium deficiency. With the exception of the fact that it is more acid, having a pH of 4.16, the soil at Slocum is very similar to that found at the experimental plats. A ton per acre of a 4-8-8 fertilizer was applied uniformly to all plats. Various amounts of magnesium in different forms were applied as shown in Table 2. Each treatment was applied in triplicate and the yields represent an average of three plats in each case.

TABLE 2.—*Yields of potatoes with different treatments on the H. K. Champlin Farm, Slocum, Rhode Island.* 1932

Pounds per acre	Magnesium supplement	MgO per acre (pounds)	Yields in bu. per acre		
			No. 1	No. 2	Total
	None		292	22	314
100	Magnesium sulfate	16.4	403	23	426
300	" "	49.2	399	17	416
300 + 500	" " + Calcium limestone	52.8	418	19	437
150	Magnesium hydrate	48.4	417	20	437
500	" limestone	100.6	416	28	444
500	Calcium "	3.6	342	27	369
1000	" "	7.3	318	27	345

From Table 2 it may be seen that the response due to magnesium is very marked. An application of 100 pounds of magnesium sulfate increased the yield 112 bushels per acre over the check. One-hundred and fifty pounds of magnesium hydrate were found to be equal to 500 pounds of magnesium limestone. Calcium limestone gave an increase in yield but not nearly as great as was obtained when magnesium was supplied. About 10 per cent of the tubers from the 1,000 pound application of calcium limestone were affected with scab.

EXPERIMENTAL PLATS—1933

In 1933 the experiment was designed to measure the response from magnesium when applied with the different phosphorus carriers. The description of the experiment has already been given. The yields on the limed half of the experiment are presented in Part A and on the unlimed half, in Part B of Table 3.

The actual response from the different phosphorus carriers may be seen on the half of the table presenting the yields where there has been no magnesium applied. It will be seen that the response from magnesium on a limed soil is much less than that obtained on the acid soil. This condition has been generally observed; namely, the greater the acidity the more danger of a magnesium deficiency.

TABLE 3.—*Response of potatoes to magnesium on limed and unlimed soil when applied with different phosphorus carriers in* 1933. *Yields in bushels per acre*

Treatment	Pounds P_2O_5 per acre	With magnesium*			Without magnesium		
		No. 1	No. 2	Total	No. 1	No. 2	Total
Part A—limed							
Superphosphate	25	117	16	133	121	18	139
"	80	187	16	203	204	21	225
"	240	289	23	312	259	24	283
Rock Phosphate	80	101	12	113	94	14	108
" "	120	104	8	112	106	11	117
Average		160	15	175	157	18	175
Part B—unlimed							
Superphosphate	25	96	21	117	88	21	109
"	80	161	24	185	51	25	76
"	240	225	35	260	111	38	149
Rock Phosphate	80	78	14	92	44	16	60
" "	120	100	11	111	53	15	68
Average		132	21	153	69	23	92

*150 pounds magnesium sulfate per acre.

A combination of high acidity and low phosphorus limited the yields very greatly. The untreated half again represents the response from the various carriers of phosphorus under unlimed soil conditions. On the treated half the variation in response under the different treatments may also be noted. The application of magnesium sulfate on the plats receiving no lime has caused an increase in yield in each case, the average increase for all the phosphorus carriers being 61 bushels per acre.

COOPERATIVE EXPERIMENTS—1933

The response to magnesium in various potato fields was measured by conducting several cooperative experiments throughout the southern part of the State. Some of the tests failed to show a significant response. On the longer cropped soils a very satisfactory response was secured. The best results were obtained from the use of magnesium limestone.

DISCUSSION

The significant response from the applications of magnesium sulfate in the experiments herein reported shows that the soil has reached a condition of magnesium deficiency. This is the result of a few definite factors; namely, magnesium has been lost continuously by leaching and crop removal and that lime and fertilizer containing relatively little or no magnesium have been used.

Soil acidity seems to be an indicator of a magnesium deficiency; that is, the more acid the soil the more danger of a magnesium deficiency. However, this is to be expected as a condition of high soil acidity generally means that the soil is low in soluble bases and especially in calcium and magnesium.

In the experiment where the various carriers of phosphorus are compared under two different degrees of soil acidity, the effect of soil reaction on response to magnesium is well defined. On the acid soil very marked increases in yield were obtained from the use of magnesium sulfate while on the limed soil no response was secured.

Bartholomew[1] found that supplementing various unavailable phosphorus fertilizer carriers with magnesium sulfate increased the amount of phosphorus absorption by the plant. The magnesium sulfate treatment also resulted in a larger yield than where the phosphorus carriers were used alone. The condition reported in this paper is somewhat different in that the potatoes were suffering from a magnesium deficiency and the response is undoubtedly due to the magnesium applied.

This is especially noticeable since the magnesium caused a marked response on the acid soil whereas on the limed soil no response was secured. This point is worthy of further investigation.

In the cooperative field experiments where the fertilizing elements were applied from similar carriers the response secured in each case was due to the various magnesium supplements applied to the standard fertilizer.

SUMMARY

1. A nutritional disease in potatoes was found to be due to a deficiency of magnesium.
2. The magnesium deficiency was found to be more severe on acid soils and under conditions where commercial fertilizers had been used in large amounts for a number of years.
3. Supplying magnesium to various phosphorus carriers, under acid-soil conditions, was effective in increasing the yields of potatoes very markedly.
4. In one cooperative field experiment yield increases of approximately 100 bushels per acre were obtained through the use of magnesium.
5. All forms of magnesium, used in these experiments, were found to be equally effective when supplying at least 25 pounds of MgO per acre.
6. Under acid-soil conditions it is recommended that magnesium limestone supplying 25 to 35 pounds of magnesium oxide per acre be mixed in the fertilizer or an occasional top-dressing of magnesium limestone be made.

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FIELD EXPERIMENTS ON POTATO-SCAB CONTROL IN WESTERN NEW YORK

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In this paper an attempt is made to summarize some of the more important results obtained in experiments conducted in Western New York for the past three summers under the direction of Dr. F. M. Blodgett. These experiments have been limited to an area in which

soils with high pH values are common and limestone outcroppings numerous. Scab has caused severe losses under these conditions, both from the lowering of grade caused directly by scab lesions and indirectly by the feeding of scabgnats and millipeds in these lesions causing more serious blemishes.

The results from seed treatments have been, in part, somewhat at variance with those obtained by most other workers during the past 40 years. No attempt has been made to summarize data from seed treatment materials which have been used only one year or for which too few comparisons are available. The results presented in table 1 refer only to those treatments on which we believe that sufficient work has been done to conclusively show trends for this district. Apparent discrepancies in this table may be explained by the fact that a few of the more standard treatments have been repeatedly used in comparison with new treatments. This leads to a large number of comparisons with the check plots but comparatively few direct comparisons between cer-

TABLE 1.—*Effect of Seed Treatment in the Control of Potato Scab.* 1931-1933

	Increase in per cent scabbed tubers				
	Hot $HgCl_2$ over	Cold $HgCl_2$ over	HgO over	HgO + CHOH 1-60. over	Check over
Hot CHOH...	62** 14.0± 2.3*	14 18.2± 3.5	14 20.8± 6.9	28 20.8± 4.5	74 5.6 ± 2.8
Cold CHOH ..	22 14.9± 2.8	26 14.5± 4.0	30 20.3± 3.3	16 15.8± 0.4	34 11.0 ± 2.8
Hot $HgCl_2$ ...		14 1.4± 0.1	29 4.2± 2.2	28 4.8± 0.4	85 —9.1 ± 1.9
Cold $HgCl_2$ ...			22 3.6± 2.1	16 —2.4± 5.1	26 —3.6 ± 1.4
HgO				31 —10.1±2.8	60 —6.6 ± 3.4
HgO + CHOH 1-60					51 —6.6 ± 6.0

*Standard Error—Any difference greater than twice its Standard Error is probably significant.

**Number of comparisons.

MATERIALS USED IN ABOVE SEED TREATMENT TESTS

Material	Concentration	Time— min.	Temp.— °F.
Hot formalin	1-120 (1 pt.—15 gal.)	2½*	126
Cold formalin	1-240 (1 pt.—30 gal.)	90*	Cold
Hot mercuric chloride	1-1000	2½	126
Cold mercuric chloride	1-1000	90	Cold
Yellow oxide of mercury	1-125 (1 lb.—15 gals.)	Dip	Cold
Yellow oxide + formalin	1-125 + 1 pt.—7½ gals.	Dip*	Cold

*Covered one hour after treatment.

tain of the treatments. Differences presented in the table may not be compared with each other but only the direct comparisons shown should be considered.

In examining table 1 we find that in a total of 62 comparisons, hot mercuric chloride gave 14.0% more scabbed tubers than did hot formalin. This difference is apparently very significant as the Standard Error of the difference is only 2.3%. The formalin treatments gave significant reductions in scab as compared with the untreated lots while the mercury treatments increased scab over the untreated and the formalin treatments.

It may be of interest to note that the yellow oxide of mercury with the addition of formalin at the rate of one pint to 7½ gallons of mixture was our most effective treatment in reducing the percentage of tubers bearing Rhizoctonia sclerotia. This treatment gave 26.0 ± 6.2% fewer tubers bearing sclerotia than the untreated, 5.8 ± 2.7% fewer than yellow oxide alone and 5.1 ± 3.2% fewer than hot mercuric chloride.

Following the successful use of mercurials in the fertilizer in New Jersey, two experiments (fields 1 and 2, table 2) were conducted by the writer in 1931 and another series was arranged by a different investigator from this Department in 1933. The average results from the latter series of three fields are presented under fields 3, 4, and 5, table 2. Examination of this table shows that in field 1 positive and significant increases in scab were obtained with all mercurials as compared

TABLE 2.—*Effect of Mercurials Added with the Fertilizer on Potato Scab*
Percentage of scabbed tubers

	Field 1 1931		Field 2 1931		Fields 3, 4, & 5 1933	
	Lbs. per Acre	Per cent Scab	Lbs. per Acre	Per cent Scab	Lbs. per Acre	Per cent Scab
Yellow Oxide	10	94.3	6	37.8	3	47.3
Yellow Oxide	17	95.0	10	37.5	6	55.5
Calogreen	17	95.5	20	57.0	5	49.9
Calogreen	32	97.0			10	62.6
Mercuric chloride ...	9	93.3	5	38.5		
DuBay "738"	62	85.0	38	40.0		
Check	..	68.8	..	49.0	..	27.2
No. comparisons	..	4	..	4		10
Significant difference*	..	7.61*	..	14.19		9.89

*Any difference greater than this is probably significant.

with the untreated plots receiving only fertilizer. In field 2 the results were variable and while no treatment was significantly worse than the untreated, Calogreen was significantly worse than all other treated plots. Fields 3, 4, and 5 show very pronounced increases in the percentage of scabbed tubers not only from the use of mercurials but from their use in increased amounts.

During the past three years we have conducted 20 experiments with sulfur treatments. Significant reductions in the percentage of scabbed tubers have been obtained in most cases where the sulfur was applied in the spring after plowing. In general, no control has been obtained for the current season where the sulfur has been applied in the fall or in the spring before plowing. In a number of the experiments it was possible to study the comparative value of different types of sulfur in scab control. All of the different types used gave reductions in the percentage of scabby tubers that were significant (table 3). The inoculated sulfur, however, failed to give better control than the other kinds used and indeed seems to be definitely inferior for scab control in these tests. No good reason is known why the inoculated sulfur should be inferior to the commercial sulfur of the same fineness, as the inoculum used could scarcely have been detrimental. It might reasonably be expected that the more finely ground wettable and dusting sulfurs would oxidize more rapidly to form acid and this would account

TABLE 3.—*Effect of Type of Sulfur on Potato Scab*
Summary of 1931, 1932 and 1933 data
Difference expressed in per cent scabbed tubers

Kinds of Sulfur	No. Comp.	Check over	No. Comp.	Inoculated over
Inoculated	70	8.5 ± 2.55*		
Mist Brand wettable.	48	13.3 ± 3.58	32	9.8 ± 1.56
Dusting	48	13.2 ± 5.38	32	6.0 ± 3.55
Commercial	54	12.4 ± 3.33	38	4.5 ± 1.47

*Standard Error—
Any difference greater than twice its Standard Error is probably significant.

for their effectiveness. The use of these finely ground sulfurs may not be advisable for they are usually more expensive and are more difficult to apply.

The results of a variety test (table 4) conducted during the past two seasons, in a soil heavily infested with the scab organism, show significant differences in varietal resistance to scab. Of the twelve potato varieties under test eight were grown during both seasons, Netted Gem and Heavyweight being substituted for Katahdin and Green Mountain in 1933. As the average per cent scabbed tubers of the 8

"standard" varieties was 80.8 in 1932 and 89.6 in 1933, it is believed safe to assume that the Netted Gem variety would have shown no higher percentage of scab had it been grown in 1932 as well as in 1933. This variety was significantly better than any other variety in 1933. With the exception of Netted Gem, the variety Russet Rural was significantly better than all varieties except White Blossom Irish Cobbler. All varieties down to and including No. 9 in table 4 had significantly less scab than did Irish Cobbler and the varieties which follow. The varieties White Blossom Irish Cobbler and President Kreuger were obtained from Mr. W. K. McCulloch, District Inspector, Laboratory of Plant Pathology, Kentville, Nova Scotia, and the Netted Gem variety from Mr. H. S. MacLeod, District Inspector, Victoria, British Columbia. The other varieties were obtained from New York State certified seed growers.

TABLE 4.—*Varietal Susceptibility to Potato Scab*
Average per cent scabbed tubers in 1932 and 1933

Variety	Per cent scab	Variety	Per cent scab
Netted Gem	54.0*	Heavyweight	89.7*
Russet Rural	71.1	Irish Cobbler	91.6
White Blossom I. C.	73.5	Spaulding Rose	93.4
President Kreuger	81.3	GreenMountain	95.2**
No. 9	83.1	Burbank	95.3
Katahdin	86.4**	Bliss Triumph	95.6

*Results of 1933 (sig. diff. 8.5%).
**Results of 1932 (sig. diff. 13.8%).
All others average of two years data (sig. diff. 8.1%).

SUMMARY

All of the data presented have been obtained from experiments in a district characterized by soils of fairly high pH values, most soils having values of at least pH 6.0.

Small but significant reductions in potato-scab were obtained by the use of formalin seed treatments.

Small but significant increases in potato-scab were obtained by the use of mercurial seed treatments.

The addition of mercurials to the soil has shown a consistent tendency to increase the percentage of scabbed tubers.

With equal rates of application finely ground sulfur has been more effective than inoculated sulfur.

Spring applications of sulfur after plowing have consistently given reductions in scab while applications before plowing have shown no current season control.

The varieties Netted Gem (one year's results), Russet Rural, and

White Blossom Irish Cobbler have shown a significant degree of scab resistance.

SECTIONAL NOTES

FLORIDA

There are two probable factors that have contributed toward the planting of an increased acreage of Irish potatoes in Florida this year. First the resumption of greater activity in industry resulting in an increased buying power in the industrial section in the North: second, the small crop of Irish potatoes produced in northern latitudes in the fall of 1933. The greatest increase in acreage in Florida occurs in the Homestead area where approximately 3,500 to 4,000 acres are planted to Red Bliss against 300 to 500 acres that have usually been grown there. The Hastings, LaCrosse, Bunnell and other north-central Florida producing areas do not show a tremendous increase.

Harvesting has already begun in a small way in Dade County. The crop is in excellent condition, with prospects for a very good yield. Growing conditions have not been very satisfactory in the north-central part of the state due to continued dry weather.

We have a rather interesting problem in connection with the varieties of Irish potatoes under Florida conditions. The Red Bliss is grown almost exclusively in the southern part of the state, while in the Hastings and LaCrosse areas the Spaulding Rose has been the prevailing variety. There is a feeling on the part of the growers in the north-central areas, however, that it will be desirable to make a change since from one-fourth to one-third of the potatoes dug are No. 2's. Some variety tests that the Experiment Station has been carrying on for the last couple of years show promise of one or two of the seedlings developed by the United States Department of Agriculture. Last year in a series of tests planted at different times in different fields in the LaCrosse and Hastings area a 60% increase in yield of No. 1's was obtained from one of these seedlings as compared with Spaulding Rose. These trials are going forward again this year on a more extensive scale. We have evidence also to show that this difference in performance is rather definitely linked with the tolerance to short days which prevail in Florida during our growing season.—M. R. Ensign.

Potatoes for shipment to northern markets are produced in three sections of Florida. In the northern part of the state the oldest and most important potato producing area centers around the towns of Hastings and Lacrosse. A newer production center is that found near

Homestead in the extreme southern part of the state. Recently there has been considerable interest in the crop in the Everglades.

The potato acreage in the state is considerably larger than a year ago. The short crop in the northern states has no doubt encouraged many growers to increase their acreage. Another factor is seen in the increasing competition which Florida vegetables have encountered for several years. This had led many growers to shift part of their acreage from tomatoes and beans to potatoes. The total acreage has been estimated to be about 23,000. Of this amount Hastings has 16,000; Lacrosse, 2,000; Homestead 3,500, and Palm Beach County (Everglades and East Coast) 500. There are about 1,000 acres scattered in minor areas.

Most of the crop in the Everglades was marketed by February 15th, although a few later plantings were made which will not mature until April. The Bliss Triumph is the only variety grown in this section. Northern certified seed was used in all of the plantings and was liked very well. All of this crop was produced on a muck soil which requires not over 500 pounds of a 0-8-24 fertilizer per acre. Growing conditions have been good since October, and no losses from early or late blight have occurred. Several growers reported yields in excess of 300 bushels of U. S. No. 1 potatoes per acre. The ease with which large crops of potatoes can be obtained, and the favorable market conditions this year are apt to induce bean growers to change part of their acreage to potatoes next year. If present intentions are followed this area may double or treble the potato acreage in 1934-35.

The Homestead area has begun harvesting and should finish in March. The Bliss Triumph variety is the only one grown here. Since the crop is grown on calcareous marl soil with a highly alkaline reaction the yields are not as high as in the Everglades. A very fine crop can be produced, however, by the addition of manganese sulphate and about one ton of a 5-8-5 commercial fertilizer. Some trouble from insects and early blight has been encountered. The general use of certified seed has eliminated most of the trouble from virus diseases. Yields of 200 bushels per acre are expected.

In the principal producing area of the state around Hastings the Spaulding Rose variety is the most important. Doctor A. H. Eddins states that the growers find this variety more resistant to cold and excessive soil moisture. The main crop was planted by February first and should be harvested from April 1 to April 20. Some growers experienced difficulty in securing good stands because of dry weather. Early in February Doctor Eddins reported that the crop was free from late blight. The growers have begun to dust with copper lime fungi-

cides. This section has sandy soils which require about a ton of fertilizer to the acre for best results. Yields are expected to average about 150 bushels to the acre.—G. R. Townsend.

CALIFORNIA

Potato production in California is a year-round proposition; that is, potatoes are being harvested in some part of the state during every month. The earliest plantings are made in Kern county in the Shafter-Wasco district during January and February. Next in order come Southern California (Los Angeles, Riverside and San Bernardino counties), central California (comprising several districts in the San Joaquin and Sacramento Valleys) and the limited district in Humboldt county. Planting of the second crop in southern California begins late in the summer, after which the winter crop in San Diego county and the Colma district near San Francisco is planted. The following table indicates the monthly rate of car-lot shipments from 1927 to 1930, inclusive. Yields are comparatively light in the winter crop but in the Shafter-Wasco district, and in southern California, yields of 250 sacks (100 lbs. each) are not uncommon while in the Delta, yields of over 300 sacks are often secured.

CALIFORNIA POTATOES: MONTHLY SHIPMENTS 1927 TO 1930, INCLUSIVE

Month	1927	1928	1929	1930	Average, 1927-1930, inclusive	
	cars	*cars*	*cars*	*cars*	*cars*	*per cent*
January	412	688	836	644	645	8.3
February	263	558	534	510	466	6.1
March	103	282	406	509	325	4.2
April	109	127	79	148	116	1.5
May	151	445	137	810	386	5.0
June	882	974	614	1,286	939	12.2
July	839	607	932	545	756	9.8
August	1,273	678	1,052	884	972	12.7
September	1,041	794	986	1,016	959	12.5
October	745	828	897	777	812	10.5
November	744	711	690	652	699	9.1
December	661	718	607	500	622	8.1
Total for each year...	7,323	7,410	7,769	8,281	7,696	

Recently, growers in Imperial Valley have become interested in potato production and varietal tests are now being made there. Frost hazard, light yield and the stalk borer, as well as competition with established districts, may combine to make potatoes unprofitable in Imperial Valley.—D. R. Porter.

MISSOURI

The outlook for the planting of at least an average acreage of early potatoes in Missouri is favorable. This is true because producers who

have been engaged in the business over a series of years find that, on the average, early potatoes generally give as satisfactory yields and returns as most any other crop produced.

The tendency toward the use of better methods, including more satisfactory seed, improved methods of treatment, the use of better soil and the employment of improved cultural methods will unquestionably result in better yields in this state.

The potato district of Missouri is confined largely to the central section of the state, including such counties as Ray, Chariton, Carroll, St. Louis, and others.—T. J. TALBERT.

PENNSYLVANIA

Our potato meetings at the Farm Show at Harrisburg in January were the largest we have ever held. An unusually large number of letters are coming in regarding potato growing, many of them apparently from farmers and land owners who have not been in the game in a commercial way. While it is too early to estimate the probable potato acreage in Pennsylvania for 1934, all indications point to an increase.

Our acreage in 1933 was a little below that of 1932, but the average yield was somewhat higher—outside a large area where the season was extremely dry, the yield was considerably better than in 1932. Prices were about double those of 1932, so that it was the best year most growers have had for quite a while. The early crop was especially profitable and the acreage of Cobblers will doubtless be increased. Two factors will tend to hold down acreages and yields for 1934; namely, higher fertilizer prices, which will mean smaller applications, and high seed prices. The latter will not figure so much with the late crop, since a great many of our growers buy only enough certified stuff to grow seed for the following season. Salesmen at the Farm Show reported extra good demand for seed potatoes, however, especially in the case of Cobblers.

Much poor stuff will no doubt be planted this year. Extremely low temperatures have probably frosted some seed in cellar storages. These factors will probably lead to some poor stands and low yields.

I know one dairy farmer whose regular practice is to plant potatoes, on a commercial scale, only in years when seed is cheap. In this way, his costs of production are always relatively low. He can grow eight or ten acres with little extra labor or expense. Having plenty of manure, he needs little fertilizer. When seed is cheap, the crop usually brings a good price, while when seed is high in price the crop is often cheap.

It seems a pity that there are not more growers like the above to even up production over a term of years.—J. B. R. DICKEY.

NORTH CAROLINA

North Carolina early potato growers are now preparing their land for planting. The usual planting dates are from about February 10 to March 1. A few over ambitious growers of the Beaufort section planted just before the recent cold weather and the probabilities are that they have lost their seed. Because of the favorable market and good prices received last season a considerable increase in acreage of early potatoes is indicated for this state. In some counties it is reported that there will be as high as 40 per cent increase in planting over last year. It will cost somewhat more to grow and market the crop this year owing to rise in wages, cost of seed and cost of barrels. Practically all of the early crop is of the Cobbler variety and the greater part of the seed used comes from Maine and Prince Edward Island.—ROBERT SCHMIDT.

NORTH DAKOTA

The Northeastern Breeders' Association is a group of large farmers who some years ago organized for the breeding of purebred cattle. Very soon they took on the production of improved seed, and as the seed business grew and potatoes proved to be the leading seed for which they had an outside market, the organization has changed very largely from a cattle breeding group to a certified seed potato association.

They still produce improved wheat, barley and flaxseed and some improved alfalfa and sweet clovers.

Mr. H. D. Long, the regional deputy seed commissioner under E. M. Gillig, seed commissioner of Fargo, North Dakota, for a long time was seed analyst in the latter office. He now is stationed at Park River with offices at the Walsh County High School and is in charge of certification, of the field inspectors used for that work and of the carlot shipping point inspection service. He finds time to make improved selections, to produce foundation stock of seed potatoes, and to do quite a little breeding of flax and other grains. E. J. Taintor, the secretary of the Northeastern Breeders' Association, is the salesman for several hundred carloads of seed potatoes and other improved seed. The Association has purchased 80 acres of land adjacent to the school, for additional facilities for the work of Mr. Long and Mr. Taintor.

After we discovered that there was no better Cobbler seed stock in America than chanced to be built up at Fosston in Polk County, Minnesota, and that a good deal of this stock carried forward too much

spindle tuber, we appealed to Mr. Long and to Mr. Taintor and his organization to take this high grade stock of Cobbler seed, clean it up of virus disease and put it on a carlot basis. There now are between two and three carloads of this purified Fosston Cobbler strain. Tests have shown that it is fully equal to the best Cobbler seed produced in Maine or in Prince Edward Island. This stock has filled and will fill a large place in the foundation seed supply of the Red River valley. A. G. Tolaas, chief inspector of the Minnesota certification deal told me that he agrees that there is no better Cobbler stock in America than the Fosston, Minnesota Cobblers.

On a detached farm in one of the side valleys of the Red River up near the Canadian line in North Dakota, an Iceland farmer by the name of Stefan Melstad was discovered by Mr. Long to have a fine stock of Cobbler seed of unknown origin. He selected a number of the best hills from Mr. Melstad's field and tried them out for season and health and productiveness, and selected one hill in this progeny as the best and earliest of them all. We have had some excellent results from this seed. It now is in carlot production. It is a week or ten days earlier than standard Cobbler stock.

Mr. Long has done similar work with the early Ohios and has an early strain of this variety. He also has what appears to be an extra early Green Mountain. It came from Norway originally, is called the Viking and has a season about that of the early Ohio. This potato can be had in carlots. Mr. Long, during the past winter, increased his foundation stock of Chippewas in Florida, and will have this new U. S. seedling to sell as soon as anybody.

They have done similar work with the Triumphs. Their Triumphs, grown on heavy ground, can be had free from scab and with minimum virus disease content. Right now, Mr. Taintor can supply about three-quarters of a carload of Katahdins. Prices on certified seed of these varieties run, according to quotation on February 7, from $2.10 to $2.15 per hundred F. O. B. Park River and nearby towns in North Dakota. This is the present commercial price for any certified seed out of that district.—C. L. Fitch.

MAINE

Those closely connected with the potato deal in Maine are quite optimistic for developments in the next six weeks. A larger part of the stocks on hand at present are in the hands of growers than is usually the case.

During the recent cold waves very little stock has moved from farm

storage and practically all of the shipments have come from dealers stocks on tracks. While the growers are inclined to move freely, at present prices it is doubtful if they would sell on a decline, and with the dealers shipping from hand to mouth, heavy haulings from farm storage should not appreciably effect the market.

From present current trends in daily shipments Maine will apparently ship over 50,000 cars. This increase over last year's shipment of 44,000 cars may be accounted for by the shipment of seconds or off grade stock this year. We of course have a larger crop than a year ago but not enough to account for from six to eight thousand cars.

Seed is moving freely with a total shipment to date of 1,217 cars against 817 last year. This of course is partly accounted for by the increase in acreage in the early states, but part is also caused by early purchasing of requirements as a protection against price advance.

The loans secured from the Regional Agricultural Credit Corporation and the United States Department of Agriculture Seed Loans are pretty well paid up. From general reports the erroneous impression might be gained that Maine farmers are recovering entirely from the depression. Such is not the case. They will undoubtedly recover part of their losses of the previous two years, but unless a very substantial advance occurs in the near future they cannot recover completely.

Indications at present point to an increase in acreage in Maine as well as elsewhere. Just what steps will be taken to counteract this tendency or to curtail shipments the coming season remains a mystery as yet. It appears probable that some action will be taken through Governmental Agencies to prevent a future catastrophe.

Apparently the Seed Loans of the U. S. D. A. will be reduced from last year. The larger part of the grower financing will be carried by the Production Credit Associations organized under the Farm Credit Administration. Such an Association has been set up with headquarters in Presque Isle to cover Northern Maine. Applications are coming in freely now, and it would appear that they will assume an important place in the financing of this next crop.

All of which bears out the strong conviction that there is urgent need for intelligent, economic planning in production and shipment of potatoes as well as in many other lines of economic activity. We hope that some day a more ordered system will be evolved.—FRANK W. HUSSEY.

LOUISIANA

The potato industry in Louisiana is growing rapidly; each year sees new shipping points developing. At the present time most of the

crop is planted in Lafourche, St. James and Terrebone Parishes. Pointe Caripee and Rapides Parishes are the central potato districts of the state. Planting dates in Louisiana range from about January 15 to February 20 with most of the acreage planted from February 1st to 15th. Growers are using more fertilizer and better cultural methods than heretofore. We have found that 800 pounds of a 4-12-4 plus 160 pounds of sulfate of ammonia, applied when the plants mark the row, give most economical yields. Our results indicate also that an ounce seed piece spaced 14 inches apart gives the largest yield of No. 1 potatoes.

We are certifying our U. S. No. 1 small Triumphs for sale to the countries south of us. Our seed is giving excellent performance in Cuba and other Central and South American countries.—JULIAN C. MILLER.

REVIEW OF RECENT LITERATURE

Botrytis cinerea as a cause of tuber rot, DONALD FOLSOM *(Phytopathology, Vol. 23 (1933), No. 12, Pp. 993-999, fig. 2).*—In 1932, the writer found a new kind of rot in tubers of the Green Mountain variety in storage houses. The exterior of the tuber showed a flabbiness and a wrinkling of the skin that was much more pronounced at the stem end. At the juncture of the flabby and normal tissue, a soft rot was disclosed which caused a temporary darkening of the flesh. The eyes were filled with tufts of gray mold. Infection appears to have started at the stem end indicating that this took place chiefly or only by internal mycelia entering from infected stems through the stolons. In 1931, this same organism caused considerable injury to leaves and stems in some fields in Maine.

A World Record, WALLACE MACFARLAND *(Better Crops with Plant Food, Dec. 1933, Jan. 1934).*—A yield of 1155.8 bushels per acre was obtained on a measured acre on the Weyl-Zuckerman & Co. farm at Stockton, California. Ten sacks of seed potatoes were used per acre and the seed pieces were spaced 10 inches apart in 30-inch rows. The seed bed was prepared with a pulverizing machine and 1,000 pounds of a 0-15-12 fertilizer was applied per acre. The fertilizer was applied two inches below the seed pieces over a width of 10 inches and was thoroughly mixed with the soil to a depth of 8 to 10 inches. The crop was planted April 1st and harvested September 18th, 1933.

Fertilizer-mercury combinations for the control of scab and rhizoctonia, WM. H. MARTIN *(Hints to Potato Growers, Vol. 14*

No. 8, 1933).—Field experiments were conducted since 1927 to determine the value of various mercury compounds, mixed with the fertilizer, for the control of scab and rhizoctonia. Organic mercury compounds were used in the early tests but were later replaced by calomel and yellow oxide of mercury. These proved to be equally effective but the latter is objectional due to its irritant properties. Since 1931, seven tests were conducted where a comparison was made between fertilizer alone and fertilizer plus six pounds of calomel. In these tests, 50 per cent of the tubers in the former plots were free from scab as compared with 81.5 per cent where the fertilizer-mercury combination was used. The average yield was 227.3 bushels where the fertilizer was used alone and 224.0 bushels from those receiving the fertilizer plus six pounds of calomel per acre. Five tests were conducted in fields where russeting and misshapen tubers resulted from the activity of the rhizoctonia organism. In these tests, 54.8 per cent of the tubers were clean on the plots receiving fertilizer alone as compared with 88.8 per cent for those receiving fertilizer plus six pounds of calomel. The average total yield of the latter plots was 242.9 and of the former, 252.8 bushels an acre.

These tests demonstrated that where the fertilizer-mercury mixture was applied in the row, or in a manner so as to come in contact with the seed piece, injury followed. Little or no injury followed its application in two bands approximately two inches to each side and on the same plane as the seed piece.

Best results in the control of scab followed where the mercury compounds were used in soils having pH values approaching those which are likely to inhibit the development of the scab organism. In the case of high pH values, the small amounts of mercury used were less effective.

Seed treatment for potato black-leg, JOHN TUCKER and E. W. HARBER *(Scientific Agr., Vol.* 14 (1933), *No.* 2, *Pp.* 70-72).—Results obtained from seed treatment for the control of black-leg in fields entered for certification over a period of five years are reported. Seed for 23,959 fields, which was not treated, showed an average crop loss of .34 per cent. In 13,218 fields, where the seed was disinfected in mercuric chloride, the average crop loss was .18 per cent and in 6,847 cases where formalin was used, the average loss was .31 per cent. The results of the survey indicated that local conditions have considerable effect on the extent of the disease. It was observed also that practically the only fields that showed a relatively large amount of black-leg were planted with untreated seed.

THE PRICE SITUATION

Potato prices followed mixed trends during January. They continued to rise in the western markets, but weakened somewhat in the east. Carlot shipments set a high record for January but have slowed down slightly in recent weeks. The influence of the short 1933 crop is now becoming apparent, particularly in the Central States, and market prices may be expected to continue to rise during the next two months. There is an ample supply of old stock potatoes in the Eastern and Western States and shippers in these areas are getting unusually wide distribution for their holdings. A few early new potatoes are arriving on the central markets and the prospects are for somewhat greater supplies this season than a year ago.

Potato prices at New York City declined from the recent high point of $2.17 per 100 pounds reached during the first week of January to $2.00 during the third week and then advanced to $2.08 during the first week of February. The weekly average price is now about 26 per cent above last fall's low compared with $1.09 per 100 pounds for the first week of February last year. At Chicago, round white prices continued to rise throughout January. During the first week of February they averaged $1.82 per 100 pounds compared with $1.56 a month earlier, $1.12 the fall low point and 69 cents a year ago. These mixed trends in market prices have been due largely to the uneven distribution of storage supplies.

F. O. B. prices at Presque Isle, Maine, have shown much the same trend in recent weeks as New York City prices. Prices of Green Mountains were off slightly during the middle of January, but strengthened considerably toward the end of the month. They were quoted at $1.53 per 100 pounds the first week in February, compared with $1.43 a month earlier and $1.00 at the low point reached in November. At Rochester, New York, round whites average $1.65 against $1.45 a month ago and $1.10 in November. In the Western States shipping point prices have maintained an almost steady upward trend since the November lows. During the first week of February round whites at Waupaca, Wisconsin, averaged $1.60 per 100 pounds, compared with $1.27 the first week of January and 95 cents in November. F. O. B. prices of Russet Burbanks at Idaho Falls averaged $1.40 for the first week in February against 92 cents a month ago and the November low price of 84 cents.

United States farm prices of potatoes averaged 77.2 cents per bushel on January 15, compared with 69.4 cents on December 15, 37.4 cents in January, 1933, and 64.2 cents the January average, 1910 to

1914. Present prices are only about 5 per cent below parity, based on the 1910-1914 price relationships.

The carlot movement of potatoes in January continued to run ahead of those of a year ago. The January movement of cars set an all time record for that month and total shipments this season to date exceed those of the 1932-33 season by almost 23,000 cars or 31 per cent. The weekly rate has declined somewhat during the first part of February from the high rate of January but almost 4,000 cars per week are still being shipped. The increased carlot movement this season may be attributed to the higher market prices being received this year and to the fact that the bulk of the availab'e supplies are located in the areas more distant from market centers and consequently, the total truck movement is lighter than a year ago.

A few early Florida bliss triumphs have been moving to market at about $3.00 per 100 pounds f. o. b. Forida shipping points which is silghtly higher than prices of a year ago. Preliminary estimates place the 1934 acreage at 30,600 acres in Florida and the lower valley of Texas or about 12 per cent more than in 1933. There are indications that the acreage in the other early states will also be increased. (Bureau of Agricultural Economics, U. S. D. A.)

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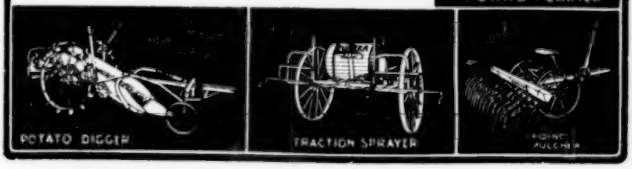

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EFFICIENCY MUST BE REWARDED

With present intentions to plant and favorable growing conditions there can be only one outcome—low prices. Everyone associated with the industry realizes this and consequently an effort is being made to curtail acreage. On the other hand, the individual grower is advised, and correctly so, that if he is to be successful he must keep his costs down by producing large yields per acre.

It has been suggested that this tendency to produce in excess of demand could be overcome by the growers themselves. This is doubtless true but unfortunately there are growers in every section who will not join any movement to further the common good. The time has come when we must subordinate the desires of the individual for the good of the whole. Consequently, if a minority continue to disrupt the entire industry some type of control will be necessary.

What type of control should we have? It has been suggested that each grower be required to reduce his acreage in the same proportion as every other grower. This system penalizes the efficient to assist the inefficient. It is an established fact that in many sections certain growers can produce a bushel of potatoes for much less than can others. If each grower is compelled to reduce his acreage or otherwise curtail his total production in the same proportion as his neighbor, the grower with high production costs would be helped but little. He would merely lose less money in a year when the selling price is low. The inefficient grower usually produces a low quality product. In view of this fact a more satisfactory procedure would be to prohibit the shipment of all second size potatoes. If this should not eliminate the surplus the next logical step would be to prohibit the shipment of all tubers which did not meet certain grade standards. By doing this the danger of a surplus would be eliminated and consumer and efficient producer alike would benefit.